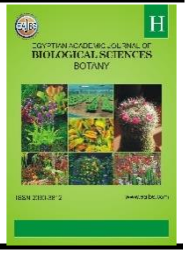
Egypt. Acad. J. Biolog. Sci., 11(1):1- 11(2020)

Egyptian Academic Journal of Biological Sciences
H. Botany
ISSN 2090-3812
www.eajbsh.journals.ekb.eg.



Assessment of Sorghum (*Sorghum bicolor* L.) Productivity under Different Weed Control Methods, Mineral and Nano Fertilization

Gomaa[1], M.A., I. F. Rehab[1], A. M. Kordy[2], and Bilkess M. A. Salim [3]

1-Plant Production Department, Faculty of Agriculture (Saba Basha), Alexandria University, Egypt.

2-Plant Protection Department, Faculty of Agriculture (Saba Basha), Alexandria University, Egypt.

3- Faculty of Agriculture, Sabha University, Sabha, Libya

E-Mail : malikaa62@gmail.com

ARTICLE INFO

Article History
Received: 2/1/2020
Accepted: 3/2 /2020

***Keywords*:**
Sorghum, NPK, mineral, nanofertilizer, weed control, yield

ABSTRACT

Two field experiments were carried out at the Experimental Farm, Faculty of Agriculture (Saba Basha), Alexandria University, Egypt during 2017 and 2018 seasons, to study the effect of mineral, nano- fertilization, in addition to different weed control on growth and yield of sorghum. Split plot design with three replicates was used, where the main plots occupied by weed control treatments(hand hoeing one time before the first irrigation, hand hoeing twice the first one was before the first irrigation and the second one was before the second irrigation, Heraty sowing method, herbicide treatment before planting and herbicide treatment before planting + one hand hoeing), meanwhile, the combination between NPK mineral and NPK nanoparticles fertilizers (100% mineral NPK (240:60:60 kg/ha), 100% nano NPK (5 L/ha) and 50 % mineral NPK + 50 % nano NPK) were distributed at random within the subplots. Each subplot consisted of 5 ridges 3.50 m in length and 60 cm in the width and the plot area was 10.5 m^2. The results revealed that, the yield and its components of the sorghum hybrid (Horas) were affected by weed control methods, mineral NPK, Nano NPK and their interaction. The highest value of yield characters of sorghum was achieved when applying hand hoeing one time with herbicide with fertilizing by 50% NPK mineral + 50% NPK NPs fertilization, also these treatments reducing the effect of weeds under Alexandria conditions.

INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is one of the three most important cereal crops worldwide after wheat, rice, maize and barley and it's an important staple food crop in Africa, South Asia and Central America. Sorghum is high yielding, easy to process, readily digested and cheaper than other crops and consumed as food and fodder. The world cultivated area in the world was 40.7 million ha produced up to 57.6 million tons of grains but in Egypt occupied about 147961ha producing up to 727648 tons of grains (FAO, 2017).Sorghum is the 5th leading cereal grain produced worldwide because sorghum is tolerant of heat and drought stress it is commonly grown under non irrigated condition in semiarid parts of the world (Kaufman *et al*., 2013).

Nanotechnology is the study of manipulating matter on an atomic or a molecular scale that deals with particle sizes between 1 and 100 nanometers at least in one dimension. This technology has the possibility to develop the agricultural and food production with new tools for the molecular treatment of diseases, rapid disease detection, increasing the ability of plants to absorb nutrients etc. Materials reduced to the nanoscale show some properties which are different from what they exhibit on a microscale, enabling unique systemic applications. Nanoparticles, thus, take advantage of their dramatically increased surface area to volume ratio. Nano-fertilizers postpone the release of nutrients and extended the period of fertilizer effects. Obviously, there was an opportunity for nanotechnology to significantly affect energy and the environment by enhancing fertilizers (Naderi and Danesh-Shahraki, 2013).

Using nanoparticles (NPs) in agriculture has beneficial values for plant growth and development due to their relatively greater absorbance and high reactivity (Liu and Lal, 2015). Using nano-fertilizers as a foliar spray at vegetative, flowering or filling stages increased the yield and yield components of faba beans (Gomaa *et al*., 2016). Nano fertilizers can improve morphological and agronomic characteristics of sorghum and can be useful for goals sustainable an agriculture (Mir, 2015). Fertilizing the maize with a foliar application of nano- fertilizer (PK) and a soil application of mineral fertilizer (PK) improved maize yield (Gomaa *et al*., 2017). The plant height, yield and yield components of the wheat crop increased after the application of nano-fertilizer (Kandil and Marie, 2017). On the other hand,(Al-Juthery *et al*., 2018a) found that when compared to the same quantity of 11essential nutrients nano-fertilizers were significantly superior for all growth parameters. A significant response will be spraying combined of tri (N+P+K), di (N+P), (N+K) and (P+K) nano-fertilizer compared to control and traditional (NPK+TE) fertilizer treatments in all growth and yield parameters of wheat with an increment of the foliar spray . The highest fertilizer productivity was achieved when spraying treatments of nano mixture of (N+P+K) fertilizers compared to traditional fertilizer (Al-Juthery *et al*., 2018b).The application of nano-fertilizer (NPs) promoted growth, development and antioxidant activity in sugar beet plants and improved crop production and plant nutrition. Moreover, nano-fertilizers have a great effect on the soil and can reduce fertilizer application frequencies (Dewdar *et al*., 2018). Using NPs with NPK nutrients increased the yield and its components of wheat compared with fertilization of mineral NPK in both seasons (Abdelsalam *et al*., 2019).This investigation aimed to study the response of maize yields and its components to organic manure (compost) and different potassium sources.

Nitrogen is a key factor for plant photosynthesis, ecosystem productivity and leaf respiration (Martin *et al.,* 2008). Nitrogen stress may affect the light use efficiency and consequently influence long-term changes in vegetation biomass and carbon sequestration (Peng *et al.,* 2012). Increase nitrogenous fertilization rates up to 200 kg/ha increased yield and its components of maize (Dawadi and Sah, 2012). Nitrogen fertilization levels, maize hybrids and their interactions showed such significant effects on maize growth, crop yield and its components. The maximum values of crop growth and yield characters (Kandil, 2013). There were gradual and significant increases in all growth parameters and grain yield resulted from foliar spray by raising N- fertilizer up to 288 kg N/ha (Faheed *et al*., 2016).The highest means values of yield and chemical composition characters were obtained using nitrogen fertilizer at the rate of 384 kg/ha, in both seasons, while the lowestones were recorded by application of nitrogen at 192 kg/ha, in both seasons (Gomaa *et al.,* 2016).

Phosphorus (P) is essential for enhancing seed maturity and seed development (Ziadi*et al*., 2008). Both P and K application favored tillering of crops and reduced lodging in crops (Liakas*et al*., 2001), developed photosynthetic activity and transport to the ripening grains and recorded the highest values of grain yield (Crista *et al*., 2012; Rietra*et al*., 2017; Hadis *et al.*, 2018). With adequate levels of phosphorus, 20% more grain yield of wheat can be obtained (Abdel-Aziz *et al.*, 2016). N and P uptake could be increased with increased P additions (Abdel-Aziz *et al*., 2018).

Potassium (K) helps in photosynthesis process, controlling water storage and stomata opening in leaves (Zhang and Wang, 2005). Potassium is an important macronutrient for improving the yield of the crop. It is vital for physiological processes, water availability, photosynthesis, assimilate transport and enzyme activation with a direct effect on crop production. Potassium absence significantly reduces the leaves number and size of individual leaf and as a result, photosynthetic activity of the plant was affected (William, 2008). Higher crop growth rate might be exhibited due to higher photosynthetic efficiency in leaves and supplied emerging cobs with existing photosynthates for proper filling, producing a higher yield. Grain yield enhanced by increasing potassium uptake under the arid condition (Damon and Rengel, 2008).

Weed infestation is one of the major threats to cereal production in Egypt. Weed could be controlled in crops through cultural, mechanical and chemical methods, the wise use of these individual methods or a combination of them can manage weed effectively without causing economic loss or harming the environment (Magain, 2008).Weed control in grain sorghum is a challenge because of the limited number of herbicides available to growers, rotational crop restrictions following a number of herbicides registered for use in sorghum grain, and because of the increased presence of herbicide-resistant weeds. Competition from broadleaf weeds decreased grain yield of sorghum more than grass species competition or mixtures of broadleaf and grass weeds (Feltner *et al*., 1996).Weed competition the first two weeks after plant emergence has not decreased grain sorghum yields regardless of the weeds studied (Burnside and Wicks., 1967). Period of weed growth beyond two weeks after grain sorghum emergence decreased yields reliant on the weed species and environmental conditions (Smith *et al*., 1990). Weed herbicides like Metribuzin might have also shorter was lesser persistence its volatility, rapid action and the primary mechanisms of interfering with oxidative and photosynthetic phosphorelation, important better control of weeds compare to alachlor. Similarly, among the cultural measures, intercropping suppressed with lesser weed counts, biomass and nutrient depletion by weeds. This probably because of early germination, stand establishment and ground coverage by the canopy of intercrops (Baldev Ram *et al*., 2004). Application of both herbicides and hand hoeing, individuals resulted in increased significantly. The combination between hand hoeing with pre- and post-emergency herbicides led to the most effective way for controlling weeds and thus increasing the maize of growth and its yield. Using hoeing twice or once use with one herbicide after the emergency; increased maize growth and yield. The heaviest reduction of weeds was achieved after applying hand hoeing twice or using one hand hoeing with post- emergency herbicides (Kandil and Kordy, 2013). The highest weed control efficiency was recorded with twice hand weeding at 15 and 30 DAS as compared with the other treatments. Application of metribuzin 1.0 kg/ha as weed control + intercropping with blackgram was found to be the most effective to control the weeds as compared to other treatments. The treatment recorded the lowest weed control, weed biomass production. The highest weed control efficiency and higher grain yield (Srinivasaperumal and Kalisudarson, 2019).

This investigation aimed to study the response of the sorghum hybrid productivity to different mineral NPK, nano NPK, weed control methods and their interaction.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Faculty of Agriculture (Saba Basha), Alexandria University, Egypt, during the two summer seasons of 2017 and 2018 to study the response of the sorghum hybrid productivity to different mineral NPK, nano NPK, weed control methods and their interaction.

Before planting the sorghum, the preceding crop was Egyptian clover (berseem) in the first and second season. Soil physical and chemical analysis of the experimental site is given in Table (1). Each subplot consisted of 5 ridges 3.50 m in length and 60 cm in the width and the plot area was 10.5 m^2.

Split plot design with three replications was used, where the main plots occupied by weed control treatments i.e., 1) hand hoeing one time before the first irrigation, 2) hand hoeing twice , the first one was before the first irrigation and the second one was before the second irrigation, 3) heraty sowing method, 4) herbicide treatment method before planting, and 5) herbicide treatment method before planting + one hand hoeing). Meanwhile, the combination between 100 % NPK mineral (240:60:60 kg/ha), 100% NPK nanoparticles (5 L/ha) and 50 % mineral NPK + 50 % nano NPK). Were distributed at random within the subplots.

Ammonium nitrate (NH_4NO_3- 33.50 N%) was used as the N source which was applied in two equal doses, the first dose was before the first irrigation and the second one was before the second irrigation during both growing seasons. Potassium sulphate (K_2SO_4) form was added, at sowing time, in both seasons.Phosphorus fertilizer was applied before planting in the form of Calcium super phosphate (15.5 % P_2O_5).

The weed herbicide was applied MethaTomp (33 % EC), in which 1 L of MethaTomp contains 330 g from Pendimethalin used as pre- emergency herbicide at the rate of 4.5 L/ha (after sowing and before irrigation) (Fig. 1).

Fig.1. Chemical structure of pendimethalin

The planting date was at 15th May in both seasons. The field was hand thinned before the first irrigation to 2 plants/hill. Other good agricultural practices were done as recommended by the Ministry of Agriculture and Land Reclamation.

Table 1: Soilphysical and chemical properties of the experimental sites in 2017 and 2018 seasons.

Soil properties	Season	
	2017	2018
A) Mechanical analysis:		
Clay %	38.00	37.00
Sand %	32.00	33.00
Silt %	30.00	30.00
Soil texture	Clay loam soil	
B) Chemical properties		
pH (1 : 1)	8.00	8.10
Ec (dS/m)	2.99	3.20
1) Soluble cations (1:2) (cmol/kg soil)		
K^{+}	1.53	1.54
Ca^{++}	9.30	9.10
Mg^{++}	10.30	12.00
Na^{+}	11.50	10.60
2) Soluble anions (1 : 2) (cmol/kg soil)		
CO_3^{--}+ HCO_3^{-}	2.80	2.70
Cl^{-}	17.40	18.00
SO_4^{--}	12.60	12.50
Calcium carbonate (%)	6.50	6.60
Total nitrogen %	1.00	0.92
Available phosphate (mg/kg)	3.80	3.90
Organic matter (%)	1.42	1.41

Nano-fertilizer (8% total N, 5% total p, 3% total K,10% micronutrients, 5% Amino acids and 5% Seaweed extract), was foliar sprayed on sorghum plants at 40 and 55 days after sowing (DAS).

Plant height at harvest, 100-grain weight, grain yield, biological yield (ton/ha), harvest index (%) and protein (%) were recorded. From each experimental subplot, one square meter (m^2) was selected randomly to identify and collect *Portulaca oleraceae*. Plant height (cm), number of plants/m^2, dry weight (g), leaf chlorophyll content (SPAD) and 1000- seed weight (g) of *Portulaca oleraceae*was recorded 75 days after sowing.

All collected data were subjected to analysis of variance according to Gomez and Gomez (1984). Statistical analysis was performed using analysis of variance technique using CoStat computer software package (CoStat, Ver. 6.311., 2005). The least significant difference (LSD at 0.05) was used to compare the treatment means.

RESULTS AND DISCUSSION

A) Effect of Weed Control Methods on Sorghum Attributes:

The recorded results in Table (2) showed that plant height (cm), 1000- kernel weight (g), grain yield (t/ha), straw yield (t/ha), biological yield (t/ha),grain protein content (%) of sorghum were significantly affected by weed control methods during two seasons 2017 and 2018.

During, the first season 2017, the results cleared that in Table (2) the most effective treatment accused by one hand hoeing + Herbicide. Whereas, all characteristics such as plant height (122.42 cm) at harvesting, 1000- kernel weight (30.54g), grain yield (2.45t/ha), straw yield (3.77 t/ha), biological yield (6.22 t/ha), grain protein content (9.60%) of sorghum were significantly increased. Also, the second followed effect achieved by the herbicide alone on the all characteristics were recorded. During the second season 2018, the same trend of applications was repeated and the highest effect of application achieved by one hand hoeing + Herbicide. Whereas, all characteristics as plant height (119.92cm) at harvesting, 1000-

kernel weight (32.93g), grain yield (2.14t/ha), straw yield (3.57t/ha), biological yield (5.42t/ha), grain protein content (9.13%) of sorghum were significantly increased when compared with other treatments. While, heraty method in the two seasons. The increase in yield and its component of the sorghum plant may be due to the effect of one hoeing plus herbicide. Treatment or herbicide treatment on reducing the number of weeds/m^2 dry weight of weed/m2 and weed plant the eight as shown in Table (3).These results are in the same trend with those obtained by Feltner *et al*. (1996); Baldev Ram *et al*. (2004); Kandil and Kordy (2013); Srinivasaperumal and Kalisudarson (2019) they recorded the role of hoeing and herbicides for reducing the spread of weeds.

B) Effect of Mineral and Nano- Fertilizers on Sorghum Attributes:

The results in Table (2) showed that plant height (cm), 1000- kernel weigh (g), grain yield (t/ha), straw yield (t/ha), biological yield (t/ha), grain protein content (%) of sorghum were significantly affected by combination of mineral NPK fertilization with nano fertilizer during 2017 and 2018 seasons.

Respecting to the effect of mineral and nano- fertilizers, the results in Table (2) revealed that the application of 50 % Mineral NPK fertilizer +50% NPK fertilizer NPs recorded the highest mean values of all studied traits followed by NPK Nanofertilizer (NPs), meanwhile the lowest ones recorded with NPK mineral fertilizer in both seasons. An increase of these traits of sorghum may be due to the role of mineral + nano- fertilizers for increasing yield and its component of sorghum. These results are in the same line with those obtained by Naderi and Danesh-Shahraki (2013); Liu and Lal (2015); Gomaa *et al*. (2017); Gomaa *et al*. (2017); Kandil and Marie (2017); Abdelsalam *et al.* (2019).

C) The Interaction Effect of Weed Control Methods and Mineral + Nano- Fertilizers on Sorghum Attributes:

Respecting to the effect of interaction of method of weed control and mineral and nano- fertilizers, the results in Table (2) showed the significant effect of interaction of weed control methods and mineral and Nanofertilizer, where(hand hoeing one time with herbicide or using herbicide only + 50 % Mineral NPK fertilizer +50% NPK fertilizer NPs) recorded the highest mean values of all traits under study followed by (hand hoeing one time with herbicide + 100% NPK Nanofertilizer NPs), meanwhile, the lowest ones recorded with NPK mineral fertilizer with hearty methods in both seasons.

D) The Effect of Weed Control Methods and Mineral + Nano- Fertilizers on Weed Attributes (*Portulacaoleraceae*):

The results in Table (3) showed that *Portulacaoleraceae* attributes such as plant height (cm), number of plants/m^2, dry weight (g), chlorophyll content in leaf (SPAD), and 1000- seed weight (g) were significantly affected by weed controlling methods and combination of mineral NPK fertilization with nanofertilizer and their interaction during 2017 and 2018 seasons.

Table (3) revealed that there was significant effect of weed control methods on *Portulaca oleraceae*characters, where the lowest mean values of plant height (cm), number of plants/m^2, dry weight (g), chlorophyll content in leaf (SPAD), and 1000- grain weight/g recorded with the treatments (One hand hoeing + Herbicide) and by application of herbicides only, while the highest mean values of weed attributes obtained by heraty sowing method followed by using one hand hoeing method in the two seasons. The previous results cleared the role of herbicides for reducing all characters studied of *Portulacaoleraceae* grown in sorghum field.

Also, Table (3) cleared the significant effect of mineral and nanofertilizers on *Portulaca oleraceae*traits, where the lowest mean values of all studied characters of *Portulaca oleraceaei.e.* plant height (cm), number of plants/m^2, dry weight (g), chlorophyll content in leaf (SPAD), and 1000- seed weight were recorded with using 50 % mineral NPK + 50% nano NPK as compared with the other treatment.

The interaction between weed control methods and fertilization treatment significantly affected all studied on *Portulaca oleraceae* (Table 3).

The many investigators such as Feltner *et al*. (1996) and Burnside *et al*. (1967); Smith *et al*. (1990); Kandil and Kordy (2013); Srinivasaperumal and Kalisudarson (2019) explained the weed competition with crops for light, CO_2, water, and nutrients that may reduce yield and its components.

Table 2: Plant attributes of sorghum as affected by weed control methods, mineral, Nanofertilizer and their interaction during 2017 and 2018 seasons.

Treatments		Plant height (cm)		1000- kernel weigh (g)		Grain yield (t/ha)		Straw yield (t/ha)		Biological yield (t/ha)		Grain protein content (%)	
		Seasons											
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
A) Weed control methods													
One hand hoeing		114.00	112.00	26.93	26.35	1.17	1.45	1.85	2.01	3.02	3.46	9.07	8.35
Twice hand hoeing		110.92	108.33	28.92	30.25	1.84	1.71	2.60	2.45	4.44	4.16	9.23	8.76
Herbicide (MethaTomp (33 % EC)		118.42	116.29	30.58	32.00	2.39	1.85	3.60	3.24	5.99	5.38	9.92	8.73
One hand hoeing + Herbicide		122.42	119.92	30.54	32.93	2.45	2.14	3.77	3.57	6.22	5.42	9.60	9.13
Heraty method		106.58	104.08	26.72	26.58	1.80	1.74	2.69	2.64	4.49	4.38	9.23	8.84
LSD at 0.05 for A		4.53	4.40	1.67	2.68	0.23	0.14	0.36	0.26	0.54	0.26	0.87	1.16
B) Mineral NPK and NPK NPs fertilizer													
100 % mineral NPK		107.15	105.23	24.78	24.22	1.62	1.58	2.45	2.53	4.07	4.11	8.64	8.07
100 % NPK Nanofertilizer (NPs)		113.30	110.93	30.30	31.20	1.97	1.80	2.94	2.82	4.91	4.62	9.88	8.85
50 % Mineral NPK +50% NPK NPs		122.95	120.23	31.13	32.86	2.19	1.96	3.31	2.99	5.50	4.95	9.71	9.37
LSD at 0.05 for B		4.44	4.33	1.59	2.37	0.18	0.12	0.26	0.25	0.41	0.28	0.71	0.90
Interaction													
A x B		*	*	*	*	*	*	*	*	*	*	*	*
Interaction													
Weed control	Mineral NPK + NPK NPs												
One hand hoeing	100 % NPK Nanofertilizer (NPs)	101.75	100.88	21.65	20.45	1.09	1.28	1.75	1.95	2.84	3.23	8.44	7.63
	100 % NPK NPs	118.50	116.63	27.63	26.38	1.08	1.54	1.57	1.93	2.65	3.47	9.54	8.60
	50 % Mineral NPK +50% NPK NPs	121.75	118.50	31.50	32.23	1.33	1.55	2.22	2.14	3.55	3.69	9.22	8.82
Twice hand hoeing	100 % mineral NPK	108.00	105.63	23.50	22.9	1.18	1.42	1.81	2.10	2.99	3.52	8.00	8.02
	100 % NPK Nanofertilizer (NPs)	108.75	106.25	32.00	34.48	1.70	1.80	2.55	2.40	4.25	4.20	9.69	8.52
	50 % Mineral NPK +50% NPK NPs	116.00	113.13	31.25	33.38	2.64	1.90	3.43	2.85	6.07	4.75	10.00	9.75
Herbicide (MethaTomp (33 % EC)	100 % mineral NPK	111.50	110.13	26.25	26.38	2.06	1.92	3.05	3.05	5.11	4.97	9.41	7.55
	100 % NPK Nanofertilizer (NPs)	116.25	113.75	32.00	32.88	2.51	1.98	3.76	3.20	6.27	5.18	9.54	9.58
	50 % Mineral NPK +50% NPK NPs	127.50	125.00	33.5	36.75	2.61	2.51	3.99	3.46	6.60	5.97	10.81	9.07
One hand hoeing + Herbicide	100 % mineral NPK	113.25	110.75	27.00	26.13	2.10	1.65	3.23	3,10	5.33	4.75	8.94	8.57
	100 % NPK Nanofertilizer (NPs)	117.50	115.00	31.88	35.93	2.84	1.83	4.17	4.08	7.01	5.91	10.16	8.67
	50 % Mineral NPK +50% NPK NPs	136.50	134.00	32.75	33.93	2.40	2.08	3.9	3.53	6.30	5.61	9.69	10.16
Heraty method	100 % mineral NPK	101.25	98.75	25.50	25.25	1.70	1.59	2.41	2.46	4.11	4.05	8.41	8.60
	100 % NPK Nanofertilizer (NPs)	105.50	103.00	28.00	26.50	1.75	1.88	2.64	2.48	4.39	4.36	10.47	8.88
	50 % Mineral NPK +50% NPK NPs	113.00	110.50	26.65	28.00	1.95	1.76	3.03	2.98	4.98	4.74	8.82	9.05
LSD at 0.05 for A x B		9.92	9.68	3.57	5.29	0.39	0.27	0.58	0.56	0.92	0.63	1.59	2.11

*: significant difference at 0.05 level probability.

Table 3: *Portulaca oleraceae*as attributes affected by weed control methods, mineral Nanofertilizer and their interaction during 2017 and 2018 seasons.

Portulaca oleraceae											
Treatments		Plant height (cm)		Number of plants/m²		Dry weight (g/m²)		Chlorophyll content (SPAD)		1000- seed weight (g)	
		Seasons									
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
A) Weed control methods											
One hand hoeing		28.92	31.75	24.83	27.00	23.33	22.25	45.71	42.12	0.105	0.115
Twice hand hoeing		17.83	17.33	7.50	9.33	27.17	27.92	43.22	40.05	0.149	0.159
Herbicide (MethaTomp (33 % EC)		11.00	11.83	11.17	11.50	17.00	17.92	33.55	27.41	0.120	0.125
One hand hoeing + Herbicide		8.50	10.00	11.00	10.50	19.67	19.08	37.95	37.05	0.125	0.135
Heraty method		25.33	26.75	21.83	14.17	27.83	28.58	43.97	40.37	0.560	0.548
LSD at 0.05 for A		6.87	5.36	6.56	7.15	8.41	4.60	10.72	7.15	0.279	0.243
B) Mineral NPK and NPK Nanofertilizer (NPs)											
100 % mineral NPK		21.5	22.40	12.90	15.30	25.00	27.25	43.41	39.81	0.299	0.307
100 % NPK Nanofertilizer (NPs)		20.85	21.95	11.80	12.40	23.60	24.55	42.45	37.59	0.134	0.144
50 % Mineral NPK +50% NPK NPs		12.60	14.25	9.10	9.80	20.40	19.45	36.78	34.80	0.202	0.198
LSD at 0.05 for B		2.66	2.85	3.19	2.84	4.31	3.67	4.32	5.14	0.152	0.133
Interaction											
A x B		*	*	*	*	*	*	*	*	*	*

*: significant difference at 0.05 level probability.

CONCLUSION:

Yield and its components of the sorghum hybrid (Horas) were affected by weed control methods, mineral NPK, Nano NPK, and their interaction. The highest value of yield characters of sorghum was achieved when applying hand hoeing one time with herbicide with fertilizing by 50% NPK mineral + 50% NPK NPs fertilization by reducing growing of weeds under Alexandria conditions.

REFERENCES

Abdel-Aziz H.M.M, N.A.H. Mohammed & M.O. Aya (2018). Effect of Foliar Application of Nano Chitosan NPK Fertilizer on the Chemical Composition of Wheat Grains. Egypt. J. Bot 58(1): 87 – 95.

Abdel-Aziz, H.M.M., M.N.A. Hassaneen & A.M. Omer (2016). Nano chitosan-NPK fertilizer enhances the growth and productivity of wheat plants grown in sandy soil. Spanish Journal of Agricultural Research, 14: 1-9.

Abdelsalam, N.R., E.E. Kandil, M.A. Al-Msari, M.A. Al-Jaddadi , H.M. Ali, M.Z. Salem, and M.S. Elshikh, (2019). Effect of foliar application of NPK nanoparticle fertilization on yield and genotoxicity in wheat (*Triticum aestivum* L.). *Science of The Total Environment*, *653*, pp.1128-1139.

Al-Juthery H. W. A., H. Abdul Kareem., Radhi F. Musa; R.F.Musa and A.H. Sahan (2018a). Maximize Growth and Yield of Wheat by Foliar application of Complete Nano-fertilizer and Some of Bio stimulators. Res. Crops 19:387-393

Al-Juthery, H. W., Habeeb, K. H., Altaee, F. J. K., AL-Taey, D. K., and Al-Tawaha, A. R. M. (2018b). Effect of foliar application of different sources of nano-fertilizers on growth and yield of wheat. Biosci. Res., 15(4):3976-3985.

Baldev Ram, G. R. Chaudhry and A. S. Jat (2004). Nutrient depletion by weed control efficiency and productivity of pearl millet (*Pennistum galcum*) as influenced by intercropping system and integrated weed management. Indian J. Weed Sci., 74(10): 534- 538.

Burnside, O. C. and G. A. Wicks (1967). The effect of weed removal treatments on sorghum growth. Weeds,15:204–207,

CoStat, Ver. 6.311 (2005). Cohort software 798 light house Ave. PMB320, Monterey, CA93940, and USA. email: info@cohort.com and Website: http://www.cohort.com/DownloadCoStatPart2.html

Crista, F., R.Isidora, S. Florin, C. Laura and B. Adina (2012). Influence of NPK fertilizers upon winter wheat grain quality. Res. J. Agric. Sci., 44 (3):30-35.

Damon, P.M. and Z. Rengel (2008). Crops and genotypes differ in efficiency of potassium uptake and use. Physiologia Plantarum., 133(4): 624-36.

Dawadi, D. R. and. S. K. Sah (2012). Growth and yield of hybrid maize (*Zea mays* L.) in relation to planting density and nitrogen levels during winter season in Nepal. Trop. Agri. Res., 23 (3): 218 – 227.

Dewdar, M, M Abbas, A Hassanin and H. Aleem (2018). Effect of nano micronutrients and nitrogen foliar applications on sugar beet (Beta *vulgaris* L.) of Quantity and Quality Traits in Marginal Soils in *Egypt*. Inter.J of Current Microb. Appl. Sci., 7: 4490-4498.

Faheed, F. A., E.I. Mohamed and H. M. Mahmoud (2016). Improvement of maize crop yield (*Zea mays* L.) by using of nitrogen fertilization and foliar spray of some activators. J. Eco. Heal. Env., 4 (1): 33-47.

FAO (2017). Food and Agriculture Organization Statistics, FAOSTAT. *www.fao.org/faostat.*

Feltner, K. C., H. R. Hurst, and L. E. Anderson (1996). Tall waterhemp competition in grain sorghum," Weed Sci., 17:214–216,

Gomaa, M. A., E. E. Kandil, A.A. Zeid and B.M. Salim (2016). Response of some faba bean to fertilizers manufactured by nanotechnology. J. Advances in Agric. Res, 21: 384-399.

Gomaa, M. A., F. I. Radwan, E. E. Kandil, and D. H. H. Al-Challabi (2017). Comparison of some New Maize Hybrids Response to Mineral Fertilization and some Nanofertilizers. Alex. Sci. Exch. J., 38(3):506-514.

Gomaa, M. A., F.I. Radwan, E. E. Kandil and M. A. Emhemmed (2016). Response of two maize hybrids to spatial distribution and nitrogenous fertilization rates. J. Advan. Agric. Resh., 21 (2):311-325.

Gomez, K. A. and A. A. Gomez (1984). Statistical procedures for agricultural research: John Wiley & Sons.

Hadis H., M. Gashaw and H. Wassie(2018). Response of bread wheat to integrated application of vermicompost and NPK fertilizers. African Journal of Agricultural Research. 13(1), 14-20.

Kandil, E. and E. A. Marie (2017) Response of some wheat cultivars to nano-, mineral fertilizers and amino acids foliar application. Alex. Sci. Exch. J., 38: 53-68.

Kandil, E. E. E. (2013). Response of some maize hybrids (*Zea mays* L.) to different levels of nitrogenous fertilization. J. Appl. Sci. Res., 9(3): 1902-1908.

Kandil, E.E.E. and A.M. Kordy (2013). Effect of hand hoeing and herbicides on weeds, growth, yield and yield components of maize (*Zea mays* L.). J. of Applied Sci. Res., 9(4), pp.3075-3082.

Kaufman, R .C., J . D Wilson, S. R. Presley, H. Blanco-Canqui and M. Mikha(2013). Effect of nitrogen fertilization and cover cropping system on sorghum characteristics. Agricultural and food chemistry. Chem., f61:5715-5719.

Liakas, V., V. Rauckis and V. Paltanaviius. (2001). Influence of phosphorus and potash fertilizers on germination, tillering and overwintering of winter wheat. Mokslo Darbai. 74, 3-12.

Liu, R. and R. Lal (2015). Potentials of engineered nanoparticles as fertilizers for increasing agronomic productions. Science of the Total Environment; 514: 131-139.

Magani, I.E. (2008). Weed control in grain sorghum. J. Animal and plant. Sci., 1(1):3-8

Martin, M. E., L. C. Plourde, S. V. Ollinger, M. L. Smith, B. E. A. Mcneil (2008). Generalizable method for remote sensing of canopy nitrogen across a wide range of forest ecosystems. Remote Sens. Environ., 112: 3511–3519.

Mir, S (2015). Effects of nano and bio-fertilizers on qualitative and quantitave characteristics of forage sorghum. Arkansas grain sorghum production handbook.

Naderi, M. and A. Danesh-Shahraki (2013). Nanofertilizers and their roles in sustainable agriculture. Int. J. of Agric. and Crop Sci.; 5: 22:29.

Peng, D. L., B. Zhang and L.Y. Liu (2012). Comparing spatiotemporal patterns in Eurasian FPAR derived from two NDVI-based methods. Int. J. Digit. Earth, 5: 283–298.

Rietra, R.P. J., J. H.Marius, O.D. Chistian and S.B. Prem (2017). Effects of nutrient antagonism and synergism on yield and fertilizer use efficiency. Communication in soil science and plant analysis. 48(16):1895–1920.

Smith B. S., D. S. Murray, J. D. Green, W. M. Wanyahaya and D. L. Weeks (1990). Interference of three annual grasses with grain sorghum (*Sorghum bicolor*). Weed Technology, 4(9):245– 249.

Srinivasaperumal, A. P. and S. Kalisudarson (2019). Effect of integrated weed management in sorghum. Plant Archives, 19(1), 1161-1162.

William, T.P. (2008). Potassium influences on yield and quality production for maize. Physio. Plantarum, 133: 670–681.

Zhang, Q. and G. Wang (2005). Studies on nutrient uptake of rice and characteristics of soil microorganisms in a long-term fertilization experiments for irrigated rice. Zhejiang Univ. Sci., 6(2):147-152.

Ziadi, N., G.Bélanger, A.N. Cambouris, N.Tremblay, M.C. Nolin and A. Claessens (2008). Relationship between phosphorus and nitrogen concentrations in spring wheat. Agron. J., 100 (1):80-86.

ARABIC SUMMARY

انتاجية الذرة الرفيعة تحت تأثير طرق مختلفة لمكافحة الحشائش والتسميد المعدني والنانو

محمود عبد العزيز جمعة[١]، ابراهيم فتح الله رحاب[١]، أحمد محمد كردي[٢]، بلقيس سالم[٣]

[١]قسم الإنتاج البناتي- كلية الزراعة (سابا باشا)- جامعة الأسكندرية– مصر

[٢]قسم وقاية النبات - كلية الزراعة (سابا باشا) - جامعة الأسكندرية – مصر

[٣] كلية الزراعة – جامعة سبها – سبها – ليبيا

أقيمت تجربتان حقليتان بمزرعة كلية الزراعة سابا باشا - بمنطقة ابيس – محافظة الأسكندرية – مصر خلال موسمى الزراعة ٢٠١٧ و٢٠١٨ لدراسة تأثير التسميد المعدني والنانو ومكافحة الحشائش علي نمو وانتاجية محصول الذرة الرفيعة أستخدام تصميم تجريبى وهو القطع المنشقة مرة واحدة Split plot design فى ثلاث مكررات مع التوزيع العشوائى للمعاملات التجريبية.

أ- أقامة التجارب الحقلية للمحصول تحت الدراسة..

المعاملات التجريبية

أ- معاملات مكافحة الحشائش (القطع الرئيسية)

١- العزيق مرة واحدة قبل رية المحاياه.

٢- العزيق مرتين قبل رية المحاياه وقبل الريه الثانية.

٣- الزراعة الحراثى (الخضير).

٤- مكافحة كيماوية باستخدام مبيد حشائش (ميثا تومب بمعدل٤,٥ لتر/هكتار) بعد الزراعة وقبل الانبثاق

٥- مكافحة كيماوية باستخدام مبيد حشائش (ميثا تومب بمعدل٤,٥ لتر/هكتار) بعد الزراعة وقبل الانبثاق + العزيق مرة واحدة قبل الريه الثانية.

ب – معاملات التسميد (القطع الشقية)

١- اضافة ارضية للسماد المعدني بالمعدلات الموصي بها (١٠٠٪) على دفعتين في عمر ٢٠ و٣٠ يوم قبل رية المحاياه والرية الثانية (بمعدل ٢٤٠ كجم نتروجين و٦٠ فوسفور و ٦٠ بوتاسيوم).

٢- التسميد الورقي بسماد النانو NPK بالمعدل الموصي به (٥ لتر/هكتار) على دفعتين في عمر ٣٠ و ٤٥ يوم من الزراعة.

٣- اضافة ارضية ٥٠٪ من معدلات السماد المعدني + التسميد الورقي بمعدل ٥٠٪ من سماد النانو بنفس طرق الاضافة والمواعيد السابقة.

ولخصت النتائج فيما يلي:

- أثرت معاملات مكافحة الحشائش تأثير معنوياً على صفات النمو والمحصول والجودة لمحصول الذرة الرفيعة خلال موسمي الزراعة حيث مكافحة الكيماوية باستخدام مبيد (ميثا تومب بمعدل ٤,٥ لتر/هكتار) بعد الزراعة وقبل الانبثاق + العزيق مرة واحدة قبل الريه الثانية حققت أعلى متوسطات قيم لصفات الدراسة متبوعاً باستخدام مبيد الحشائش بعد الزراعة وقبل الري مقارنة بباقي المعاملات خلال موسمي الزراعة.
- أثرت معاملات التسميد المعدني والنانو تأثير معنوياً على صفات النمو والمحصول والجودة لمحصول الذرة الرفيعة خلال موسمي الزراعة.حيث أن استخدام ٥٠٪ من السماد المعدني + ٥٠ من سماد النانو NPK) سجل أعلى متوسطات قيم مقارنة بمعاملات التسميد الأخرى خلال موسمي الزراعة.
- كما كان التداخل معنوياً حيث أن استخدام مبيد (ميثا تومب بمعدل ٤,٥ لتر/هكتار) بعد الزراعة وقبل الانبثاق + العزيق مرة واحدة قبل الريه الثانية أو استخدم مبيد الحشائش فقط مع التسميد بمعدل٥٠٪ من السماد المعدني + ٥٠ من سماد النانو سجل أعلى متوسطات قيم مقارنة بمعاملات التسميد الأخرى خلال موسمي الزراعة.

- كما أثرت طرق مكافحة الحشائش على صفات حشيشة الرجلة مثل عدد النباتات/م٢ وارتفاع نبات الرجلة وقراءة الكلورفيل في الأوراق الوزن الجاف للحشيشة/م٢ حيث أنه كان أفضل طريقة هي العزيق مرة واحدة مع الرش بمبيد الحشائش متبوعاً بالرش بمبيد الحشائش فقط مقارنة بباقي المعاملات حيث أن طريقة الزراعة حراتي أقل كفاءة في تقليل عدد ووزن الرجلة القيم خلال موسمي الدراسة. في حين أن التسميد بمعدل٥٠٪ من السماد المعدني + ٥٠ من سماد النانو حقق اقل متوسطات قيم لصفات حشيشة الرجلة وقللت المنافسة بينها وبين السورجم أو الزراعة الرفيعة.

التوصية:

من النتائج المتحصل عليها وجد أنه لزيادة محصول وجودتة محصول الذرة الرفيعة المنزرع تحت ظروف الأسكندرية أو المناطق المماثلة يمكن استخدام طريقة مكافحة الحشائش (العزيق مرة واحدة + الرش بمبيد الحشائش قبل الانبثاق) مع التسميد المعدني بمعدل ٥٠٪ من الجرعة الموصى بها + ٥٠٪ من سماد النانو حيث ان هذه التوليفة عملت على زيادة المحصول وتقليل نمو ومنافسة الحشائش لمحصول السورجم .